Volume 22 February, 1936 *Number 2*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Wire Rope—Design, Construction and Lubrication

Belt Conveyors

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Change of Address: In reporting change of address kindly give both old and new addresses.

Wire Rope—Design, Construction and Lubrication

MOVING of materials by flexible rope connections dates back to antiquity. Over the succeeding centuries it is safe to say that the art of rope-making had a direct influence upon the development of mechanics. During this period, up to the early part of the nineteenth century, however, this development was restricted to a type of rope which today we term cordage—a product composed of twisted vegetable fibres.

About the year 1822 there was a radical development in rope making when a suspension bridge of wire was erected in Geneva. In this installation, however, the wire rope consisted of parallel strands bound together with wire and other coverings which were wrapped around in spiral form to keep the strands in place. Rope structure of this nature has marked rigidity and maximum strength, but is subject to decided limitations as to flexibility. Hence the later development of the formed rope of twisted wire strands, which began in England about 1837. This eliminated the necessity for retaining wrappings, for when fibres or wire strands are twisted together in a rope they are held together by mutual friction when tension or strain is applied.

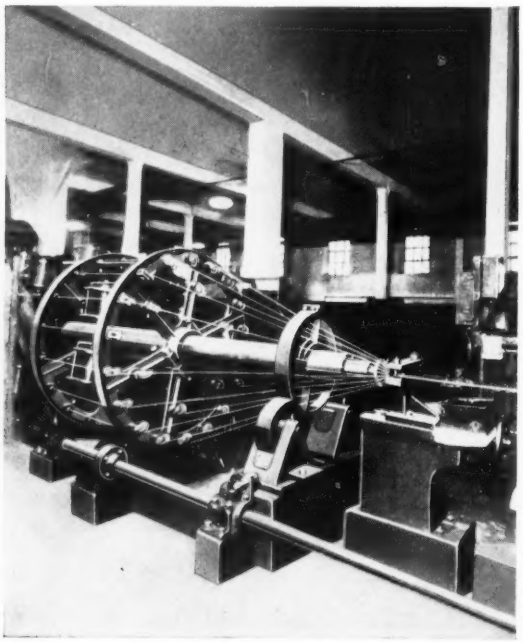
Later the advantages of the hemp core were developed, with the result that today nearly all wire rope is laid up or wound around such a core. A center of this nature furnishes a more pliable rope and a product which possesses better wearing qualities, especially where short bends or extreme flexing are desirable. Where conditions which may lead to deformation, or extreme heat are to be experienced, however, a metallic center is often substituted.

MANNER OF TWISTING

In wire rope technology the term lay has to do with the structure or type of winding. The two most prevalent types are the regular lay and Lang lay. When the wires composing the strands and the strands surrounding the core are laid up in opposite directions, the rope is of regular lay construction. The regular lay is widely used for an extensive variety of operations, such as are met with in coal hoists, derricks, cargo falls and other types of hoists; it is also adaptable to power shovels, drag line scrapers and other intensive service which reduces the life of the rope. When the strands of wire and rope are laid up in the same direction, the term Lang lay is applied. This provides a rope which is more readily untwisted, but a product which is somewhat more flexible than regular lay rope; also, because of the position of the wires in the strand, it will normally withstand fatiguing action better. Lang lay ropes are widely used in mining operations.

There is also what is known as the right and left lay. The right lay might be conveniently likened to a right hand screw of long pitch; the left hand being similar to a left hand screw. The field of usefulness of this type of rope is limited principally to elevators, and places where the tendency of the left lay rope to untwist in one direction is offset by the tendency

of a right lay rope to untwist in the other. Finally there is a type of construction known as alternate right and left lay rope. In a rope of this type, half of the strands are made of the regular lay and half of the Lang lay.



Courtesy of American Steel & Wire Co.

Fig. 1—Showing a wire rope layer. The hemp core passes through the center of the main shaft, the rope strands being wound spirally around this core by rotation of the machine. Pre-lubrication is carried out during the twisting process.

Three size wire construction predominates today; viz: the Warrington, Seale and Filler Wire; the latter being known also as Modified Seale or Spacer Seal.

In the Warrington construction there are six wires to the inner layer and twelve to the outer, all wound around a wire center. The main wires of the inner layer are of one diameter; those of the outer layer being of two diameters laid alternately; see Fig. 2a.

Seale construction calls for each strand having a wire center with nine wires each to the inner and outer layers. All the main wires of each layer are of the same diameter, as shown in Fig. 2b.

The Filler Wire or Modified Seale type of construction requires a wire center for each strand, with six wires to the inner layer and twelve to the outer. In turn, six filler wires of smaller diameter are located between these layers. As in the Seale construction, the main wires of each layer are of uniform diameter respectively; see Fig. 2c.

SERVICE CONDITIONS

In constructing machinery for the utilization of wire rope it will be found most economical to design the drums and sheaves of as large diameter as practicable, for research and practical tests have indicated that the wear on rope surfaces increases with decreasing diameters. It has also been proven that wear increases with speed and hence it is considered advantageous to increase the load within an allowable safety factor rather than the velocity. In operation one should avoid wherever possible the overlapping of wire ropes on drums. To facilitate proper rope running it has been found good practice to provide the winding drums with grooves of smooth surfaces, excellent results being obtained with grooves of slightly larger diameter than that of the rope. On the other hand, if the grooves are considerably larger than the rope diameter the effect will be deleterious due to lack of support for the ropes. When the drums are sufficiently large to permit the use of coarse ropes, these will prove more durable than the finer, more flexible ones.

PRE-LUBRICATION IN THE MILL

In the manufacture of wire rope the hemp core, which is the most prevalent type of core used today, is usually received at the mill in a treated condition to insure against deterioration and bacterial reaction. Normally, a compound of degras plus petrolatum is used followed by treatment with pine tar or copper oleate.

Lubrication in the wire rope mill starts with the stranding of the original wires, when they are treated with a suitable protective lubricant as they are led through the forming die in the process of twisting. Later these strands are again lubricated in a similar manner along with the core in the actual process of laying up the rope. The wire rope industry has carried on intensive studies to determine the lubricant best adapted to this service, to the end that a special type of petroleum compound is now widely used. This type of lubricant has been found to be especially adapted to preservation of the core. In addition, it not only serves to lubricate the strands of the hemp, but also enables the hemp core to serve as a storage reservoir for the lubricant during the entire life of the rope, to thereby more effectively protect the innermost steel strands against wear and rusting. This is especially helpful where the rope must be flexed at a comparatively sharp angle. Later, in the process of laying the steel strands around this hemp core, these strands are in turn treated with the same type of lubricant. The method used for this purpose is known as strand-stuffing in the wire rope industry. It involves application of the compound in heated condition to the individual wires and core at a focal point just before the

wires enter the die to form the completed strand.

Research has indicated that the type of lubricant to be used for this purpose must be specially prepared to meet the constructional conditions in the wire rope mill. One of the most important problems which has confronted the petroleum industry in the design of a lubricant of this type has been the development of a lubricant which will absolutely resist dripping at higher temperatures, which may at times approximate 130 degrees Fahr., and also in cold localities will not lead to cracking. It is important, of course, that any lubricant which is used in the laying up of the rope must possess the maximum of lubricating ability with extreme adhesiveness and cohesiveness, and should not contain any water such as contained in some types of grease. Furthermore, while it must not crack, it still must dry to a sufficient degree on the exterior surface of the rope in order that it will not collect dust or dirt in storage, nor lead to difficulties in subsequent handling. The above, applies to wire rope which requires complete lubrication of the structure in the course of manufacture.

There are, of course, certain types of rope for distinctive service which only require lubrication of the hemp core. Others in turn call for lubrication of the core and only part of the innermost strands, the exterior surface of the rope being bright and free from lubricant. This applies to some types of galvanized wire rope and rope which in subsequent service will not be flexed to any extent, such as guy ropes.

LUBRICATION

Initial lubrication of the hemp core, however, is not permanent. Unless protected by subsequent external lubrication, the initial charge of lubricant which has been applied to the inner structure will be squeezed out. After this has occurred it is questionable whether it can ever be renewed. So lubrication of a rope in service should be begun almost immediately it is subjected to load.

Upon the application of load various stresses are set up in each individual wire of the rope. It must, therefore, be appreciated that a wire rope is a machine requiring lubrication for its frictional surfaces just as effectively as any other power transmitting apparatus. The lubricating problem encountered in this machine is rendered still more complex by the fact that practically every unit of surface of wire rope is subjected to frictional wear in its operation.

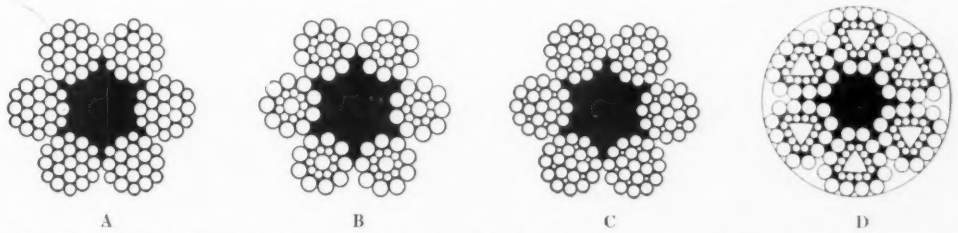
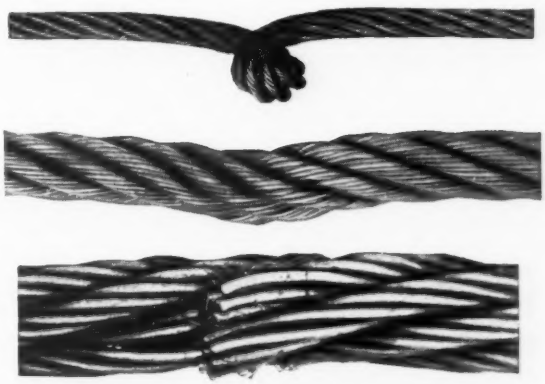


Fig. 2—*Courtesy of Hazard Wire Rope Co., and The American Cable Co., Inc.*—Showing at (A) the Warrington type construction; (B) The relative location of the strands in Seale construction, and at (C) the filler wire or modified Seale type of rope construction. (D)—*Courtesy of A. Leschen & Sons Rope Co.* The Flattened Strand type of construction for wire rope, which provides for a larger and flatter bearing area between the strands.

Nearly a century transpired between the invention of wire ropes and any real attempt to bring about effective lubrication. Modern methods of wire rope manufacture, along with careful supervision and inspection, of course, insure uniformity and high class products, but this cannot protect equipment after it has once gone into operation. For this reason rope manufacturers have extended their activities to careful study of lubrication for the purpose of being able to more intelligently select lubricants for core treatment and initial lubrication, and to understand the operating problems of their customers. All realize today that it is false economy to use wire rope without satisfactory lubrication.



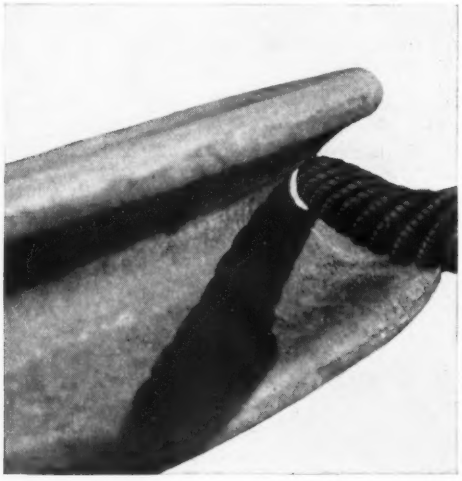
Courtesy of John A. Roebling's Sons Co.

Fig. 3—Showing the effect of kink in a wire rope. Top view is a rope badly kinked. Middle view shows the same rope with kink partially removed, and below is shown a rope which has failed due to excessive kinking.

And yet, there is no more common fault in

the operation of wire ropes than allowing them to run with insufficient lubrication, for certain types of operators have still to be convinced that even though their service may be severe, regular application of a suitable wire rope lubricant will extend the useful life of their rope. They persist in the idea that the cost of lubrication is just so much money uselessly expended. In consequence, one of the first questions a manufacturer of wire rope asks, if confronted with a complaint that his rope is not giving satisfactory service, involves the manner of lubrication.

This matter of useful life is, of course, very interesting due to its relation to production costs. In the case of wire rope it will depend upon the material used in the manufacture, the method of construction, the suitability of the rope for the service it is called upon to perform, the manner of rigging, the amount of frictional wear involved, the chemical action of the surrounding media, and lubrication.



Courtesy of Broderick & Bascom Rope Co.

Fig. 5—Above is shown a new piece of wire rope in a sheave whose groove has been worn down by the grinding action of the previous rope. Obviously this will lead to pinching, chaffing and premature wear of the new rope.

Assuming that the proper materials have been employed in the manufacture of a rope, that careful supervision has resulted in dependable manufacture, and predicating careful judgment on the part of the rope user in his selection of sheaves and drums, placement of rigging, etc., the service a rope will give varies directly with the kind of lubrication it receives. Unquestionably a wire rope will wear in service, but if it receives applications of a suitable lubricant, as its needs demand, it will not deteriorate with age.

Courtesy of Broderick & Bascom Rope Co.

Fig. 4—Showing the results of staggering clips. Obviously this may ultimately lead to breakage of the strands at the points of extreme bending.

Wire rope manufacturers have long been cognizant of the necessity for the proper preparation of wire rope cores, the object of which has been two-fold, viz., to render the rope more flexible and to furnish a reservoir for rope lubricant. They have approached this objective by saturating the hemp centers. When this procedure was first attempted, however, due to lack of experience, materials were sometimes used which were not only poor lubricants but which were actually damaging to the fibres, especially when high in acid content. Some grades of tar were found to be especially objectionable in this regard. Graphite preparations also were deemed inadequate due to their tendency to flake at low temperatures and crack when subjected to stress, thus providing a path for penetration of moisture and acids around the strands; hence the trend of research towards petroleum products.

The lubrication of wire ropes was formerly accomplished by means of surface application of variously compounded materials. The term "shield" was adopted at about the same time. In these days it was considered unreasonable to expect a protective coating to lubricate or a lubricant to act as an effective shield, so two products were generally used. The materials marketed as shields for exterior lubrication sometimes consisted of mixtures of graphite and oil, oftentimes with the addition of such substances as talc, tar and pitch to increase the viscosity or body. Products of this nature furnished merely temporary protection at the surface for they cracked, balled-up and flew off at high operating speeds; besides, the fillers would often tend to choke up the external in-

terstices and prevent the lubricating component from penetrating and reaching the points of internal wear.

Instead, a wire rope dressing should form a protective film not only over the external surface but for each individual strand and wire, even penetrating through to the center. This penetration is particularly important in the case of a wire centered rope where the steel strands which replace the usual hemp fibre are likely to be exposed to corrosive conditions. Steel centers are often used where excessive strain is anticipated, where intense heat is to be expected or as an aid in keeping the rope in shape when subjected to crushing conditions. It is important to remember, however, that should the steel center nick the interior strands the strength of the rope may be materially decreased. Obviously, failure of such a center would probably mean failure of the rope.

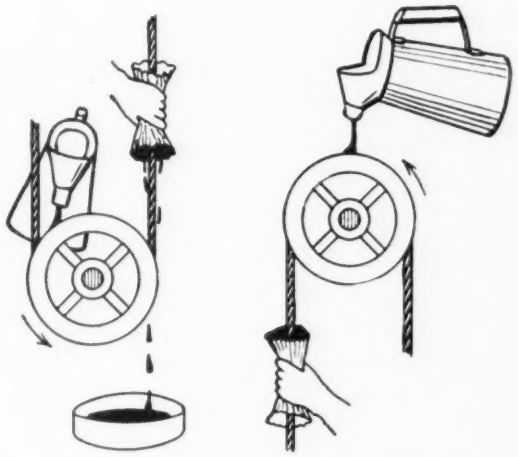
The ultimate efficiency of operation of materials handling or elevating equipment is, to a large extent, therefore, dependent upon the condition of the cables or wire ropes. We can easily realize that a rope with one or two broken strands due to rusting or wear traceable to improper lubrication, may not only cause a tie-up of the entire machine if such strands interfere with the operation of sheaves, or other companion cables, but may also present a distinct hazard. Any wire rope in such condition is just that much weaker and less capable of handling the imposed loads.

THE OCCURRENCE OF FRICTION

It is not enough to assume that because such ropes come from the manufacturers in a lubricated state, being in general wound on a prelubricated core, that further lubrication is unnecessary. Under operation there is constant friction and wear between the strands and wires, and a tendency to squeeze out any contained lubricant, especially when the ropes pass over sheaves or around drums. The renewal of this product, is, therefore, an absolute necessity.

The matter of friction between the strands of a wire rope is essentially the same as friction between a bearing and shaft. Over-heating and abnormal wear will practically always result, to reduce the load carrying capacity and increase the amount of power consumed in operation. This can only be overcome by effective lubrication, brought about by the proper application of a suitably prepared wire rope compound, which will be capable of not only penetrating to the innermost strands and core of the rope, but also sufficiently adhesive and viscous to resist being prematurely squeezed out or washed off by rain.

The use of two separate and distinctive preparations for wire rope treatment is subject to discussion, for the physical properties of both must be quite similar due to the work they must perform. Obviously, where two products are employed for service of this



Lubricating vertical ropes with sheave at bottom.

Lubricating vertical ropes with sheave at top.

Courtesy of Hazard Wire Rope Co. and The American Cable Co.
Fig. 6—Showing two methods of applying lubricant to vertical ropes.

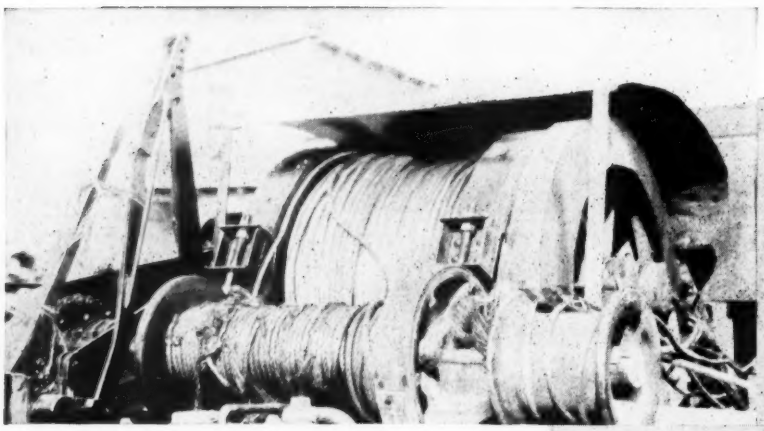
nature, if there is marked difference in their characteristics, mutual interference may result which would render it difficult for either to function as intended. Protective coatings, while possessing adhesive characteristics, often have little penetrating ability, and while external strands receive apparent protection, the internal wires may often receive neither protection nor lubrication. The practical difficulties experienced in the application of two products in service may also present added objections.

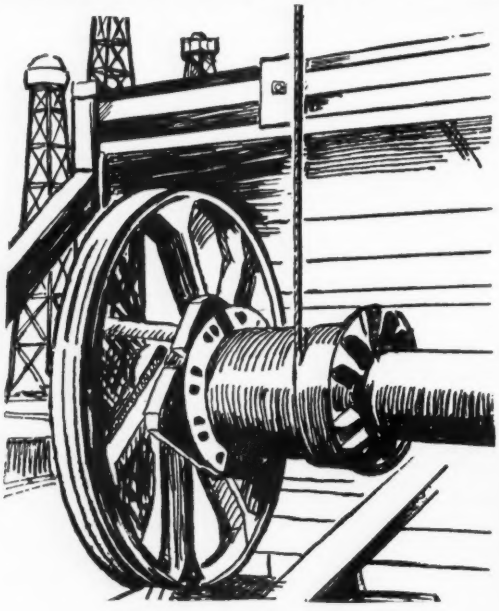
LUBRICANT CHARACTERISTICS

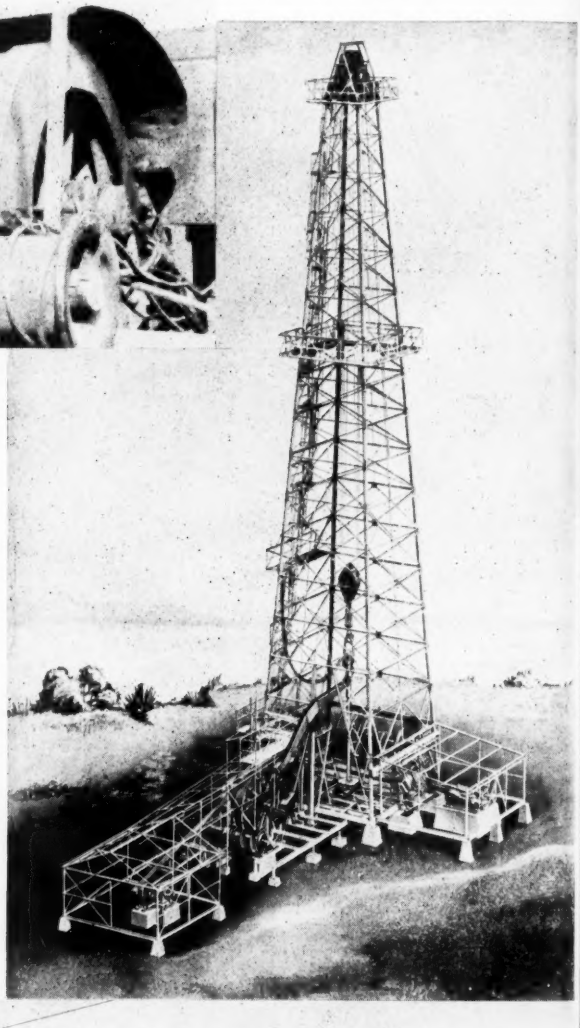
Those properties which must be possessed by a wire rope lubricant if it is to function effectively can best be outlined as follows:

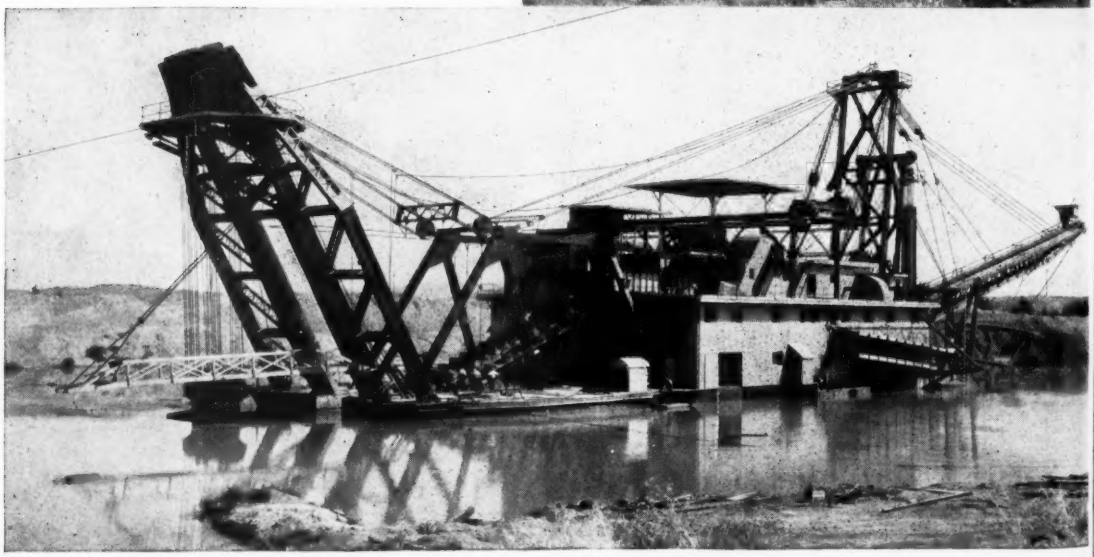
1. It must not harden, flake off under exposure, nor adhere so tenaciously to the outside wires as to result in the formation of a hollow shell through which harmful fluids might circulate.
2. It must not tend to cake, gum or ball up, especially if contaminated with excessive dust, dirt or metallic particles.
3. It must be resistant to the thinning-down effects of high temperatures. This, of course, directly involves the viscosity or relative fluidity of the product. In fact, viscosity of such lubricants is the essential characteristic involved in purchasing. It

(Top Left)—*Courtesy of Broderick & Bascom Rope Co.* Showing the effect of careless spooling in handling wire ropes in the oil fields.

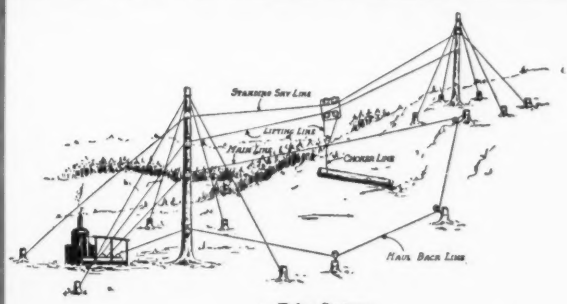




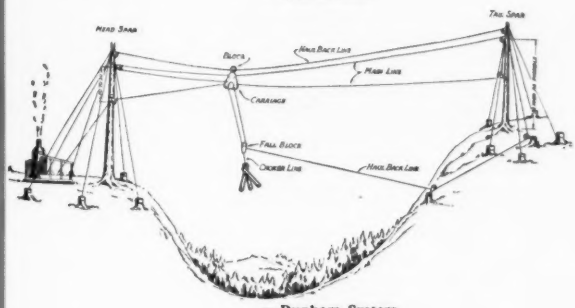




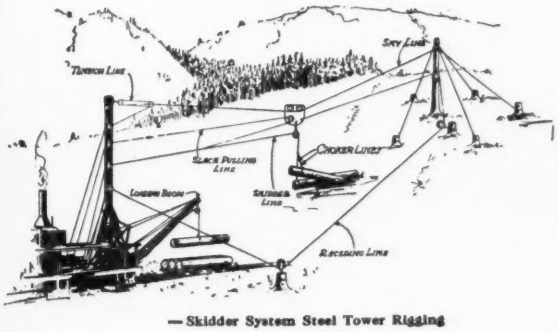
(Center Left)—*Courtesy of Hazard Wire Rope Co. Inc., and The American Cable Co., Inc.* Wire rope applied to oil field drilling service. (Top Right)—*Courtesy of American Steel & Wire Co.* Details of a rotary drilling rig. (Bottom)—*Courtesy of A. Leschen & Sons Rope Co.* Showing the wide application of wire rope in dredge operations.



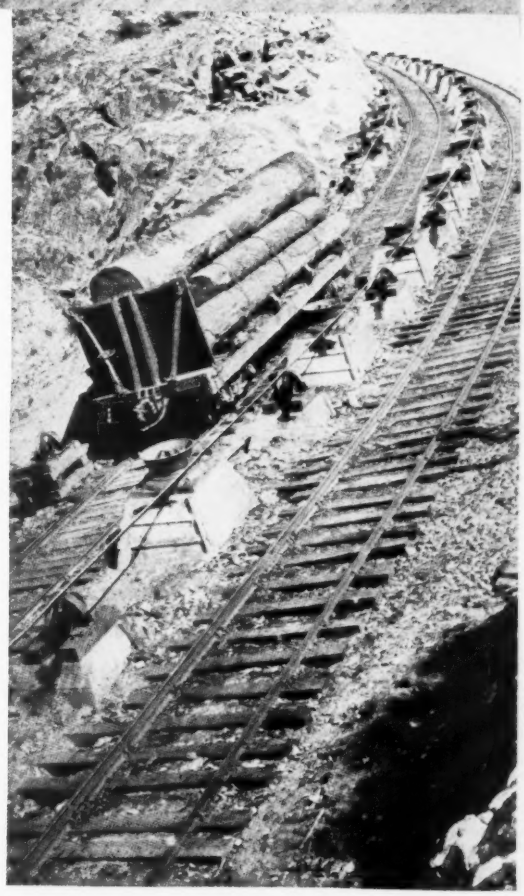
— Tyler System



— Dunham System



— Skidder System Steel Tower Rigging



(Top)—*Courtesy of A. Leschen & Sons Rope Co.* Dragline scraper operations also impose severe duty upon wire rope. (Lower Left)—*Courtesy of Hazard Wire Rope Co., Inc., and The American Cable Co., Inc.* A series of typical logging systems showing rope applications in detail. (Bottom Right)—*Courtesy of John A. Roebling's Sons Co.* Haulage rope operating under good track and roller equipment.

should not, however, be assumed as being the chief guide as to the actual suitability of a wire rope lubricant; the ability of the latter to function, penetrate and stick under actual operating conditions is of outstanding importance.

4. It must be free from acids, salts of acids or water.
5. It must be impervious to water and remain unaffected by acids or acid-laden fumes, or water surcharged with chemical impurities, generally encountered in the form of acids or salts.
6. It must be able to penetrate and form a lubricating film or coating on each individual wire.
7. There must be no chemical decomposition or mechanical separation of the lubricant even under the most severe conditions.

According to the operating temperatures that may be involved, and the possibility of the presence of an excess of water, the viscosity of a wire rope lubricant should range around 1000 seconds Saybolt at 210 degrees Fahr., or somewhat lower. In warm climates, adjacent to ovens, furnaces, etc., where there might be possibility of such a product thinning down to the extent of dripping off to perhaps result in lack of lubrication, it will be advisable to use a lubricant of approximately 1000 seconds viscosity, of course, in accordance with the temperature prevalent.

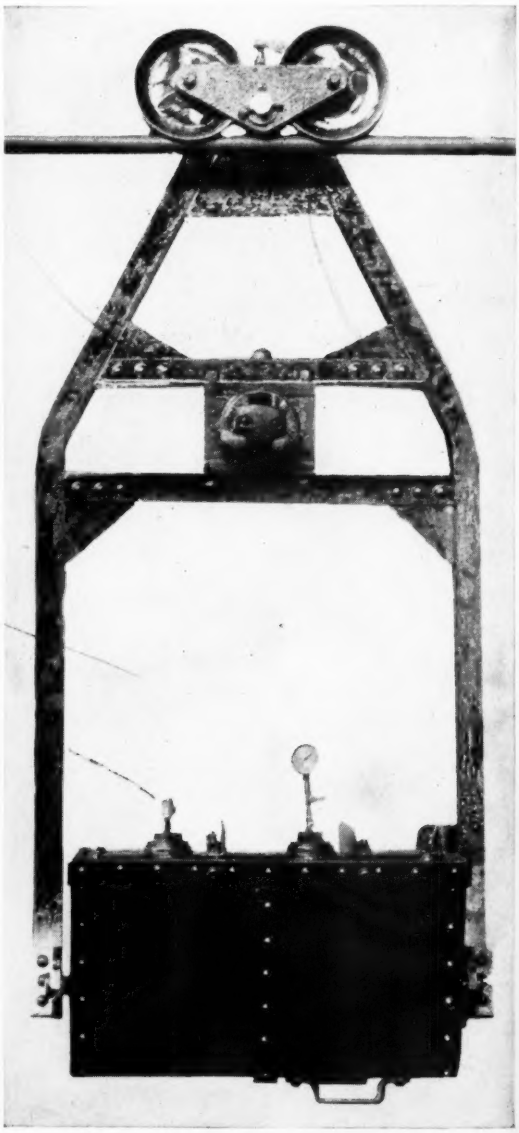
On the other hand, under relatively cold conditions as might be involved adjacent to the Great Lakes, in Canada or the Northwest, it would be advisable to use a somewhat thinner product, again in accordance with the range of operating temperatures involved.

Wire rope lubricants to meet the aforesaid requirements should, in general, be straight mineral petroleum products, devoid of fillers or thickening mediums. In other words, whatever the viscosity, it should be an inherent property of the lubricant, not an artificial characteristic which cannot be depended upon.

It is for this reason that greases or soap thickened mineral oils are relatively unsuited to wire rope lubrication. To attain the requisite body a comparatively high percentage of soap would be necessary. Soap, of course, serves as the carrying medium for the oil, but it has relatively no lubricating value, hence this property in the resultant product is decreased to a marked extent. Furthermore, the adhesive characteristic of greases is low. In consequence such products will not, in general, meet the requirements of wire rope lubrication.

APPLICATION OF WIRE ROPE LUBRICANTS

A very important detail in the lubrication of wire ropes is the application of the lubricant. Various methods have been employed and in adopting any one method or combination of methods the particular mode chosen must be dictated by the specific problem encountered. On inclined and horizontal ropes where operating speeds permit, operators very often pour the lubricant on the rope, the excess being caught in a pail which serves the double purpose of container and overflow vessel.



Courtesy of American Steel & Wire Co.

Fig. 7—Showing a track cable oiling car for tramway work. The lubricant is applied by pressure, the tank being subjected to about 35 lbs. prior to lubrication. By virtue of this pressure, the lubricant is forced upward through suitable piping to a tappet valve on the top adjacent to the rope. This valve is operated by the revolving carriage wheels.

Under favorable conditions it has also been found excellent practice to paint the lubricant

on with a brush, catching the surplus, as before, in a pail. Good results in other types of service have been obtained by providing each rope with a trough through which the rope is compelled to pass by making it run under a wheel mounted on the trough. Still another device consists of a barrel fitted with steam coils, to insure proper heating of the product, and a valve and short piping arrangement for furnishing a continuous drip flow of lubricant onto the rope, suitable means being provided, where necessary, for wiping the cable and conserving the excess applied.

Probably the most economical means of relubrication, however, is to use a form of split box of wood or metal, according to the angle of the rope in question. Such a box can be readily built in the average plant, with suitable provision for rendering it sufficiently tight to prevent the lubricant from leaking out even when reduced in viscosity by heating. The slow passage of the rope through such a bath of heated compound will insure that not only will the surface be coated, but also that the requisite penetration takes place to the inner strands. Further working of the rope over the sheaves before the lubricant has time to cool entirely, will tend to aid in bringing about the maximum of penetration.

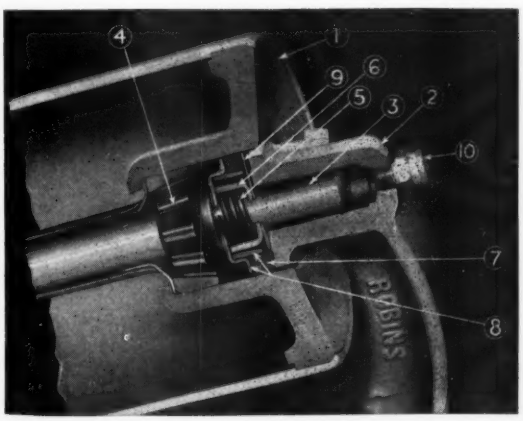
Hot Application Advisable

As a general rule wire rope lubricants, by virtue of their viscosity and comparatively heavy body, must be applied in heated condition. To merely attempt to daub or paint a rope with such a product at normal temperatures would be relatively impossible. Even though the surface might be more or less coated, the possibility of penetration occurring to any extent would be remote. We must realize that this latter is the secret of effective wire rope lubrication where the one lubricant must both lubricate the interior structure and coat the surface as a protection against entry of foreign matter. The amount of wear occurring between the exterior of such a rope and the sheaves is not as marked as that which occurs between adjacent strands when the rope is flexed or bent as in passing over sheaves, or hoisting drums.

Belt Conveyors

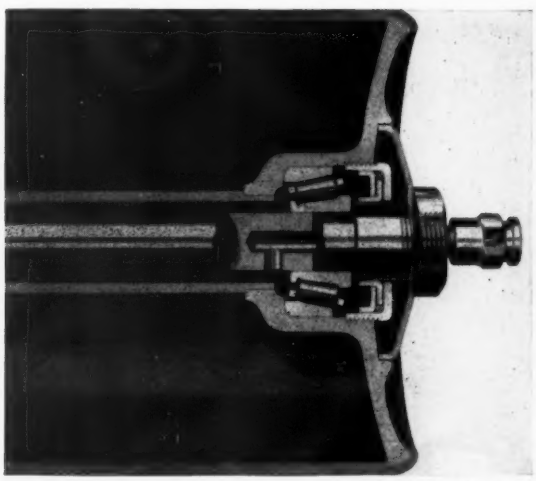
Conveyor design has progressed markedly during recent years due to the advantages to be derived from handling bulk materials mechanically. Primarily a labor saving device in the beginning, the belt conveyor immediately proved its adaptability to speeding up production and reducing personal hazards to plant personnel. It was logical, then, for this type of conveyor to become one of the most widely applied mechanisms in the entire field of industrial production. It can be used outdoors or indoors; for grain, sugar beets, coal, crushed stone, packaged foodstuffs or beer bottles, etc.; for one-level transportation or for elevating purposes. Truly, its diversity of service is remarkable.

The basic principles of design of the belt



Courtesy of Robins Conveying Belt Co.

Fig. 8—Details of the Robins conveyor idler, showing at (1) the pulley, (2) the supporting bracket, (3) the hollow steel shaft, (4) Timken tapered roller bearings, (5) automatic wear adjustment, (6) steel housing for spring, (7) cork composition seal, (8) seal retainers for cork washer, (9) seal labyrinth washer, and (10) pressure grease fitting.



Courtesy of Link-Belt Co.

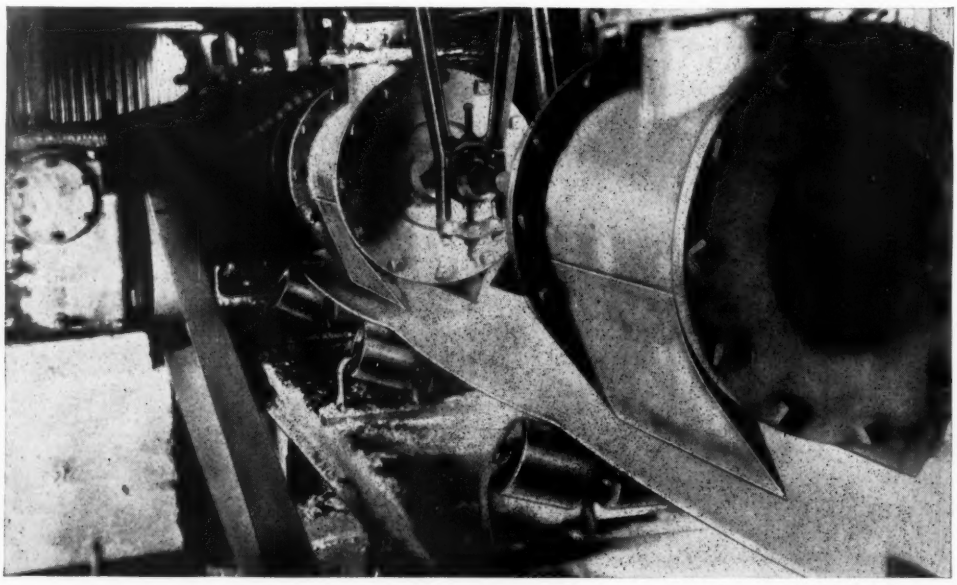
Fig. 9—Cutaway showing construction of Link-Belt anti-friction roll. Note relative location of bearings and method of sealing to prevent egress of lubricant.

conveyor involve an endless belt of rubberized fabric, canvas or cotton, designed to travel over pulleys at the conveyor ends, the loaded area being supported on troughed idlers. For the handling of bulk materials, the idler assemblies are so designed as to allow the belt to form a natural trough. Packaged materials, on the other hand, can readily be handled on a straight flat belt. The return or lower part of the belt is normally carried over straight idlers, regardless of the angle of the working side of the belt. Conveyors of this type will handle any materials which will not adhere to its carrying surface and which can be fed thereto, at an angle up to 18 or 20 degrees, according to the nature of the product to be handled.

Most economical handling, of course, can be accomplished where the belt can be run at the maximum speed for the products handled. For large loose materials this will range from 150 to 250 feet per minute for a fourteen inch belt, with the possibility of increase up to 700 feet for wider belts carrying finer products such as grain. Package conveyors, in turn, function best within a speed range of from 75 to 125 feet per minute. Picking and sorting conveyors, however, must be slowed down to around 50 feet.

Courtesy of Link-Belt Co.

Fig. 10—Showing a Link-Belt conveyor in grain elevator service.



Courtesy of Chain Belt Company

Fig. 11—A typical example of the service to which Rex-Stearns idlers may be subjected to in chemical plant operations.

BELT MATERIALS

Conveyor belting must be chosen with due regard to the type of materials to be handled, their prevailing temperatures, their moisture content and plasticity.

Normally, where any type of belt material may have to come in contact with oils, acids, water, steam or corrosive gases, it should be specially treated to render the structure impervious to their destructive action.

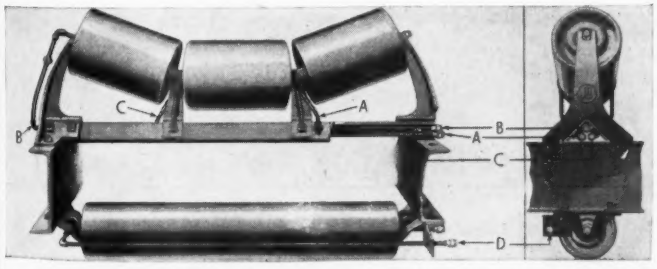
Courtesy of Robins Conveying Belt Co.

Fig. 12—Lubrication by hand pressure gun of troughing idlers can be readily accomplished, as indicated above.

Belts of rubber construction are suited to handling of any type of wet or dry materials which are relatively non-plastic. The maximum temperature under which such belts should be used is in the neighborhood of 200 degrees Fahr. Continued contact with materials any hotter will cause premature deterioration of the belts.

For temperatures above this range, but not exceeding approximately the boiling point of water, a type of stitched canvas belt has been developed which is capable of handling either wet or dry materials, provided they are not too plastic or abrasive.

Cotton belting in turn is adaptable to handling of light, dry, non-abrasive materials or packaged goods at normal temperatures. The cotton belt possesses a distinct advantage in that it combines strength with exceptional flexibility.



Courtesy of The Jeffrey Manufacturing Co.

Fig. 13—View showing arrangement of extended grease pipes to permit of lubrication from one side on Reliance troughing and return idlers.

FACTORS AFFECTING POWER ECONOMY

Power consumption is an important item in belt conveyor operation. This will, of course, be governed by the load, the incline and the tension on the belt. Experience has proved that by handling the belt over free rolling troughed idlers the power consumption can be materially reduced. Hence the advantage of the anti-friction bearing and positive lubrication with a low torque grease capable of functioning over a wide range of temperatures. On the other hand, the sleeve type bronze-bushed bearing is useful for certain types of work, especially where belts of considerable width are used requiring an idler assembly of cast iron pulleys.

The experienced operator, however, considers more than the rolling of the idlers. He must also be concerned with the running straightness of the sides of the belt. Any unevenness is regarded as an indication of wear and scuffing of the side of the belt as it runs over certain idlers, due to improper adjustment of the latter. Good judgment is, of course, necessary to determine this. To the casual observer inspection of such a conveyor might seem to indicate that all parts are operating quite satisfactorily, yet there might be serious power losses.

In conveyor service one must consider, therefore, belt wear along with bearing wear.

Both are at times difficult to prevent in a conveyor having a thousand or more sets of rolls and a belt of several thousand feet in length. Both, furthermore, will lead to marked increase in power consumption. Belt wear, as induced by scuffing, in turn, is claimed to increase the running temperature of the belt fabrics, which will ultimately reduce the carrying strength and cause breakage.

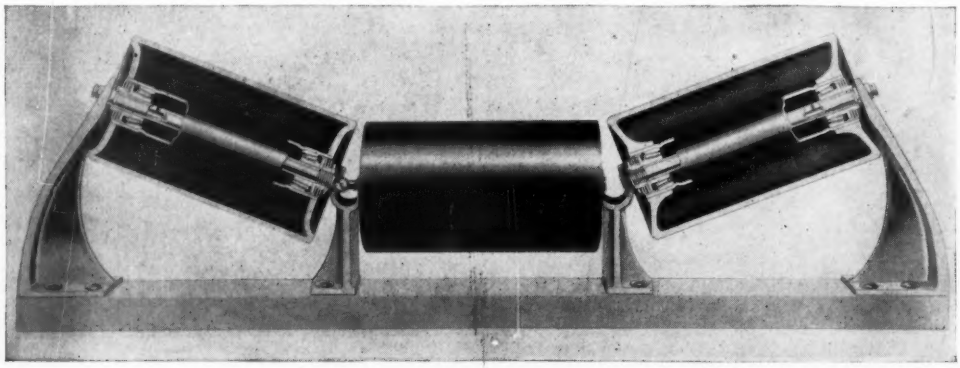
So, belt conveyor troughing and return rolls must be studied from two angles; (1) that of adjustment in order that the alignment of each conforms as nearly as possible to the operating line of the belt, and (2) that of lubrication and prevention of contamination of lubricants.

The modern conveyor designer has gone largely to the ball or roller bearing. In addition, he has studied pressure lubrication, bearing seals and methods of grease application. The result has been the development of a highly satisfactory design in practically all respects. The operator, in turn, is interested in ease of lubrication, for with many thousand roll sets, it is obvious that re-lubrication may be slighted if it involves much trouble. It is for this reason that some sets are designed for lubrication from one or two points only—at the end of one or both of the side rolls, with provision for distribution of grease through suitable ducts to the bearings of the center rolls.

By charging the bearing lubricating system at regular intervals in this way pressure can be built up from within to effectively prevent entry of abrasive or corrosive foreign matter. An added feature is the application of a highly protective type of labyrinth seal which not only aids to prevent entry of dust and dirt, but also serves to work the lubricant to maintain its texture and prevent separation, hardening and premature breakdown.

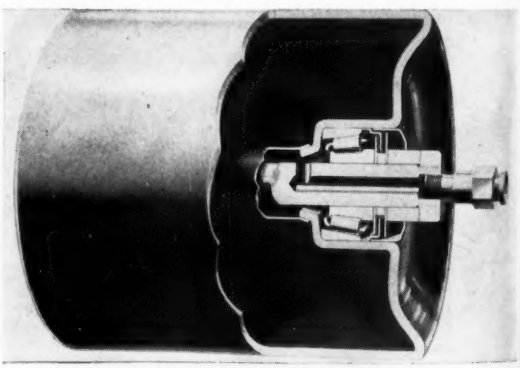
In the opinion of some authorities, however, lubricating in this manner may lead to insufficient lubrication of the center roll if the lubricating system can become air bound. Under such conditions, the trapping of air in pockets in the bearing housings might prevent complete circulation of grease. For this reason they prefer to lubricate the bearings of each roll individually by partial disassembly of the roll set at the time of lubrication. The apparent success resulting from this procedure is indicated by the reported necessity for relubrication but once every three months, and the contention of operators that their power and repair costs are consistently low.

The use of a cone-shaped seal capable of expanding when acted upon by the charge of grease under pressure from the grease gun has also been used to good advantage in connection with the above procedure.



Courtesy of Chain Belt Company

Fig. 14—Rex-Stearns idler construction in detail. Note in particular means provided for individual lubrication of each of the Timken tapered roller bearings. As insurance against grease leakage a triple labyrinth grease seal of the centrifugal type is used. Each roll is a unit in itself and can be readily removed.



Courtesy of The Jeffrey Manufacturing Co.

Fig. 15—The grease reservoir used on the Reliance belt idler. Note that a grease pocket is formed between the two bearings by a small tube each end of which is secured to an inner extension of the end of the roll.

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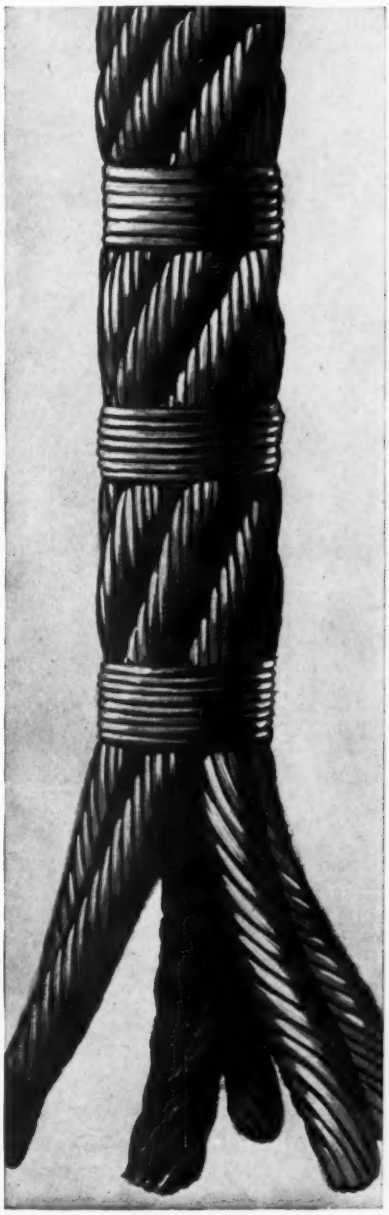

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